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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/819,343	03/28/2001	Calvin T. Gabriel	39153/298 (F0785)	4248

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Katherine D. Lee
FOLEY & LARDNER
Firststar Center
777 East Wisconsin Avenue
Milwaukee, WI 53202-5367

EXAMINER

SAGAR, KRIPA

ART UNIT

PAPER NUMBER

1756

DATE MAILED: 05/20/2003

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/819,343

Applicant(s)

GABRIEL ET AL.

Examiner

Kripa Sagar

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 November 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 July 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 8,11 6) ☐ Other: _____

DETAILED ACTION

Response to Amendment

1. The amendment filed 11/26/02 has been entered.

Claims 9,13,14,19 are amended; no new matter has been added.

Claims 1-24 are under consideration.

Double Patenting

2. The non-statutory double patenting rejection presented in the earlier office action is withdrawn in view of the terminal disclaimer filed 11/26/02.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
4. Claims 17-24 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 17-24 depend from claim 16 which recites an IC device; whereas claims 17-24 recite a process of making an IC device. It is not clear if the Applicant intends to claim the device or the process of making it. Examiner has assumed that the Applicant intended to claim the IC device recited in claim 16.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

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A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 1,9 are rejected under 35 U.S.C. 102(e) as being anticipated by US Pat. 6232048 to Buynoski et al.

The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

Independent claims 1,9 recite a method of trimming a patterned resist feature, by modifying the top of the feature by ion implantation. The modification is such that the vertical etch rate is made slower than the lateral etch rate. The differential etch rate is used to trim the feature.

Buynoski teaches a method of preparing narrow resist lines. The steps include forming a resist pattern with an initial width W1 and height H1; subjecting the pattern to ion bombardment normal to the surface so that the top of the pattern is modified— wherein the modification results in the formation of a hardened, chemically less reactive skin on the top; isotropically etching the feature – wherein the lateral etch rate of the resist feature is greater than the vertical etch rate because of the hardened top; and

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thereby forming a feature with reduced width w2 and height h2 smaller than W1 and H1 respectively. (Fig. 2; abstract).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 2-8, 10-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Pat. 6232048 to Buynoski et al. as applied to claims 1,9 above in view of US Pat. 5962195 to Yen et al.

The claims recite among others: flood exposure of resist to ions (cl.2,11), minimal etching of top (cl.12), removal of the top (cl.8,14), forming sub-lithographic features (cl.6,13), plasma etching (cl.7), modifying the top (cl.10) by selecting the energy and mass of an ion or adjusting the dose of the ion (cl. 4,5).

The teachings of Buynoski have been discussed above. Buynoski teaches the elements of claims 1,9. In addition it also teaches: removal of the top of the resist (fig.2), minimal etching of the top to maintain enough height of feature for subsequent processing (1;55-60 & 2;8-13), forming sub-lithographic features (3;33-36), adjusting the thickness of the of the modified top (3;23-30). Adjusting the dose and species to modify the top is suggested (3;7-16). Thus Buynoski teaches or suggests the elements of claims 4-6,8,10,12-15.

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Buynoski does not teach flood exposure (2.11), fluorinating (cl.3) or plasma etching (cl.7).

Yen teaches flood exposure of a resist feature to an ion-beam to modify its etch rate; the plasma pre-treatment comprises flood exposure to Ar⁺ or F⁺ ions (9;10-10;5). The pretreatment affects the etch rates which is used to form sublithographic features using a plasma etch (10;6-35).

Buynoski and yen attempt to solve the same problem – namely trimming a gate pattern to sublithographic widths. It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute flood exposure of a resist feature to ions as taught by Yen for Buynoski's ion-bombardment because Yen teaches that there is a reasonable chance of successfully hardening the top of the feature and to reduce its etch rate by flood exposure. Plasma etching of features and trimming the width of patterns by an isotropic etch is routine in the art as taught by Yen (2;19-59).

9. Claim 16-24 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over US Pat.5876903 to Ng et al.

Claim 16 recites an IC device formed by resist modification.

Claims 17-24 recite the process of modifying the top of the resist so that the etch rates of the modified and unmodified regions are different. The differential etch rates are used to trim the resist pattern.

Ng teaches an IC device with sublithographic pattern dimensions formed by resist hardening. It teaches the steps of patterning and developing a patterned feature, modifying the top portion of the resist to have an etch rate different from the bottom

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(Fig.4,5). It teaches ion implantation using Ar ions of at least 1 KeV and doses of 10^{12} to 10^{15} ions/cm² (4:47-61) . Ng does not trim the resist structure. It does not teach differential etch rates of the modified and unmodified regions of the resist.

In the event any differences can be shown for the product of the product-by process claims 16-24, as opposed to the product taught by Ng, such differences would have been obvious to one of ordinary skill in the art as a routine modification of the product in the absence of showing of unexpected results; see also *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985); and *In re Marosi*, 710 F.2d 798, 802, 218 USPQ 289, 292 (Fed. Cir. 1983); and *In re Brown*, 459 F.2d 531, 535, 173 USPQ 685, 688 (CCPA 1972).

Response to Arguments

10. Applicant's arguments with respect to claims 1-24 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kripa Sagar whose telephone number is 703-605-4427. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark F Huff can be reached on 703-308-2464. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

A handwritten signature in black ink, appearing to read "Mark F. Huff", with a stylized flourish at the end.

MH/ks
May 19, 2003

MARK F. HUFF
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700